

UTILIZING SHALLOW VERTICAL SEISMIC PROFILING TO REDUCE COSTS OF ENVIRONMENTAL RESTORATION.

Robert W. Bainer

Beginning in 1992, Lawrence Livermore National Laboratory has been researching the potential of shallow high resolution seismic reflection and vertical seismic profiling (VSP) technologies, and their application in delineating shallow subsurface features (less than 300 feet deep) which may influence contaminant flow and transport. The technology has been field tested in both two and three dimensional (2-D and 3-D) applications, and at sites with differing lithologies, geologic settings, and depths of unsaturated zone.

Results indicate that sites with a shallow water table, and relatively consolidated and homogeneous subsurface geology, provide the highest quality data for environmental applications. VSPs are not only more cost-effective in shallow investigations than surface seismic, but are directly tied to existing wells, can be implemented in urban environments where cultural effects, such as buildings and traffic disrupt conventional surface acquisition, and can provide valuable subsurface information for the implacement of extraction and monitoring systems.

We found that the reflections that we recorded with 2-D shallow surface seismic tied well with sand bodies present in wells located along the seismic line. In addition, shallow VSP data was essential for validating seismic velocity information, frequency content and reflectivity. In areas with a shallow water table, the data recorded is of much higher quality, and is not affected strongly by ground roll, attenuation or tube waves. By the application of radial designs of the VSP acquisition, we can infer the spatial distribution of subsurface geological features, which has lead to the implacement of extraction wells, yielding higher flow rates than previously encountered.

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